WHAT IS CLAIMED IS:

1. A segment joined armature for a multi-phase *ac* machine comprising:

an armature core having slots, *q* (= integer greater than two or more) for each pole in each phase, the slots being arrayed in a circumferential direction of said armature core; and

an armature winding made up of *m* (= integer greater than three or more) phase coils, each of the phase coils being made up of a first phase winding and a second phase winding which are identical in number of turns and extending in opposite winding directions,

wherein each of the first and second phase windings is made up of at least one wave winding segment and lap winding segments joined alternately, the wave winding segment and the lap winding segments being formed by sequentially joined-conductor segments, each of the conductor segments including a substantially V-shaped head portion, a pair of leg portions extending from ends of the head portion, disposed in two of the slots of said armature core located at a given interval away from each other, and a pair of joint end portions extending from ends of the leg portions, *s* (= integer greater than four or more) of the leg portions being arrayed within each of the slots of said armature core in a radius direction of said armature core, each of the joint end portions of each of the conductor segments being joined to one of the joint end portions of another of the conductor segments to make each of the first and second phase

windings,

wherein the wave winding segment is made up of the conductor segments having the leg portions located at an interval away from each other which is greater than or equal to one pole pitch, each of the lap winding segments being made up of the conductor segments having the leg portions located at an interval away from each other which is less than one pole pitch, and

wherein an end of the first phase winding and an end of the second phase winding are formed by two of the leg portions of the conductor segments which are disposed adjacent to each other in the radius direction within the same one of the slots of said armature core and which lead to two first terminal leads, and the other end of the first phase winding and the other end of the second phase winding are formed by two of the leg portions of the conductor segments which are disposed adjacent to each other in the radius direction within the same one of the slots of said armature core and which lead to two second terminal leads.

2. A segment joined armature for a multi-phase *ac* machine as set forth in claim 1, wherein four of the leg portions of the conductor segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings are broken down into a first and a second group, the first group being made up of the conductor segments having the first and fourth

layer conductors separated from each other at a given slot pitch, the second group being made up of the conductor segments having the second and third layer conductors separated from each other at a given slot pitch, wherein tips of the joint end portions leading to the first layer conductors are joined to tips of the joint end portions leading to the second layer conductors, and tips of the joint end portions leading to the third layer conductors are joined to tips of the joint end portions leading to the fourth layer conductors, wherein the wave winding segment is made up of the conductor segments each having the tips of the joint end portions separated from each other at an approximately two pole pitch, and each of the lap winding segments is made up of the conductor segments each having the joint end portions separated from each other at an approximately zero slot pitch, and wherein the first and second layer conductors or the third and fourth layer conductors defining ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired first terminal leads, respectively, and the third and fourth layer conductors or the first and second layer conductors defining other ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired second terminal leads, respectively.

3. A segment joined armature for a multi-phase *ac* machine as set forth in claim 2, wherein the pairs of the first terminal leads of the phase coils are located at an interval away from each other

which is equivalent to an electrical angle of $2\pi/m$ within an electrical angle range of approximately $2\pi(m\text{-}1)$, and wherein the pairs of the second terminal leads of the phase coils are located at an interval away from each other which is equivalent to an electrical angle of $2\pi/m$ within an electrical angle range of approximately $2\pi(m\text{-}1)$.

4. A segment joined armature for a multi-phase *ac* machine as set forth in claim 3, wherein the pairs of the second terminal leads form neutral point joint leads which are connected at a neutral point to establish a star-connection of the phase coils.

5. A segment joined armature for a multi-phase *ac* machine as set forth in claim 2, wherein the first terminal leads of the first and second phase windings of one of the phase coils form input/output lines of a first phase, the first terminal leads of the first and second phase windings of a second one of the phase coils form input/output lines of a second phase, wherein the second terminal leads of the first and second phase windings of the one of the phase coils are connected to the input/output lines of the second phase, and wherein the first and second phase windings of each of the phase coils are connected in parallel to each other, and the phase coils are connected in a delta form.

6. A segment joined armature for a multi-phase *ac* machine as set forth in claim 2, wherein each of the first and second phase

windings of each of the phase coils includes a first turn coil made up of the wave winding segment and the lap winding segments to form turns around said armature core, a second turn coil made up of the wave winding segment and the lap winding segments to form turns around said armature core, and an anomaly conductor segment connecting the first and second turn coils in series, and wherein the first and second phase windings of each of the phase coils extend in opposite winding directions and are identical electromagnetically with each other.

7. A segment joined armature for a multi-phase *ac* machine as set forth in claim 6, wherein the anomaly conductor segments of each of the phase coils are disposed adjacent to each other within two of the slots separated from each other at a slot pitch shorter than said slot pitch of the wave winding segments and the lap winding segments by at least one slot pitch.

8. A segment joined armature for a multi-phase *ac* machine set forth in claim 2, wherein locations of interfaces between the first and second terminal leads of each of the phase coils and the conductor segments are defined across the V-shaped head portion of the anomaly conductor segment in a circumferential direction of said armature core.

9. A segment joined armature for a multi-phase *ac* machine as set forth in claim 1, wherein four of the leg portions of the conductor

segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings are broken down into a first and a second group, the first group being made up of the conductor segments having the first and fourth layer conductors separated from each other at a given slot pitch which is shorter than a pole pitch by one slot pitch or more, the second group being made up of the conductor segments having the second and third layer conductors separated from each other at a given slot pitch which is shorter than the pole pitch by one slot pitch or more, wherein tips of the joint end portions leading to the first layer conductors are joined to tips of the joint end portions leading to the second layer conductors, and tips of the joint end portions leading to the third layer conductors are joined to tips of the joint end portions leading to the fourth layer conductors, wherein each of the first and second phase windings includes a first turn coil, a second turn coil, and an anomaly conductor segment, the first turn coil being made up of the wave winding segment formed by the conductor segments each having tips of the joint end portions separated from each other at approximately two pole pitch and the lap winding segment formed by the conductor segments each having tips of the joint end portions separated from each other at approximately one slot pitch, the wave winding segments and the lap winding segments being connected alternately to make turns, the second turn coil made up of the wave winding segment and the

lap winding segments connected alternately to make turns extending in the same winding direction as that of the first turn coil, the anomaly conductor segment having legs disposed in two of the slots separated from each other at a pitch different from that of the wave winding segment and the lap winding segments to connect the first turn coil and the second turn coil in series, and wherein the first and second phase windings of each of the phase coils are identical with each other electromagnetically and extend in opposite winding directions.

10. A segment joined armature for a multi-phase *ac* machine as set forth in claim 9, wherein the anomaly conductor segments of each of the phase coils are disposed adjacent to each other within two of the slots separated from each other at a slot pitch shorter than said slot pitch of the wave winding segment and the lap winding segments by at least one slot pitch.

11. A segment joined armature for a multi-phase *ac* machine as set forth in claim 9, wherein the first and second layer conductors or the third and fourth layer conductors defining ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired first terminal leads, respectively, and the third and fourth layer conductors or the first and second layer conductors defining other ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired second terminal leads, respectively, and

wherein the first terminal leads form input/output lines, and the second terminal leads form neutral point joint leads are connected at a neutral point to make a star-connection of the phase coils.

12. A segment joined armature for a multi-phase *ac* machine as set forth in claim 9, wherein the first terminal leads of the first and second phase windings of one of the phase coils form input/output lines of a first phase, the first terminal leads of the first and second phase windings of a second one of the phase coils form input/output lines of a second phase, wherein the second terminal leads of the first and second phase windings of the one of the phase coils are connected to the input/output lines of the second phase, and wherein the first and second phase windings of each of the phase coils are connected in parallel to each other, and the phase coils are connected in a delta form.

13. A segment joined armature for a multi-phase *ac* machine as set forth in claim 11, wherein locations of interfaces between the first and second terminal leads of each of the phase coils and the conductor segments are defined across the V-shaped head portion of the anomaly conductor segment in a circumferential direction of said armature winding.

14. A segment joined armature for a multi-phase *ac* machine as set forth in claim 9, wherein each of the phase coils has a bridging conductor segment extending over the anomaly conductor segment

to establish a series connection of the first and second phase windings, the bridging conductor segment including leg portions disposed within the slots which are defined by the first and third layer conductors or the second and fourth layer conductors, wherein leg portions of the bridging conductor segment form a trailing one of the leg portions of the conductor segments of the first phase winding and a leading one of the leg portions of the conductor segments of the second phase winding, and wherein the leg portions of each of the bridging conductor segments are disposed within two of the slots which are the same as those within which the leg portions of the first and second phase windings of a corresponding one of the phase coils leading to the first and second terminal leads are disposed.

15. A segment joined armature for a multi-phase *ac* machine as set forth in claim 1, wherein four of the leg portions of the conductor segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings includes a first turn coil, a second turn coil, and an anomaly conductor segment, the first turn coil including first lap winding segments, second lap winding segments, and the wave winding segments which are joined alternately to make turns, the first lap winding segments being made up of ones of the lap winding segments formed by the conductor segments having the joint end portions separated at a joint pitch of approximately 1/2 slot pitch

and the second and third layer conductors separated at a first slot pitch shorter than the pole pitch by one slot pitch or more, the second lap winding segments being made up of ones of the lap winding segments formed by the conductor segments having the joint end portions separated at a joint pitch of approximately 1/2 slot pitch and the fourth and fifth layer conductors separated at the first slot pitch, and the wave winding segments having the joint end portions separated at a joint pitch that is identical with two pole pitches minus sum of the joint pitches of the first and second lap winding segments and the first and sixth layer conductors separated at the first slot pitch, the second turn coil being made up of winding segments identical with the first lap winding segments and winding segments identical with the second lap winding segments which are connected alternately to make turns oriented in the same winding direction as that of the first turn coil, the anomaly conductor segment having leg portions disposed within two of the slots separated at a slot pitch different from the first slot pitch to establish a series connection of the first and second turn coils, and wherein the first and second phase windings of each of the phase coils are identical with each other electromagnetically and extend in opposite winding directions.

16. A segment joined armature for a multi-phase *ac* machine as set forth in claim 15, wherein the first and second layer conductors disposed adjacent to each other within a same one of the slots belong to the first and second phase windings connected in parallel,

respectively, and wherein the fifth and sixth layer conductors disposed adjacent to each other within a same one of the slots belong to the first and second phase windings connected in parallel, respectively.

17. A segment joined armature for a multi-phase *ac* machine as set forth in claim 16, wherein the first and second layer conductors disposed adjacent to each other within a preselected one of the slots lead to an end of each of the phase coils, wherein the fifth and sixth layer conductors disposed adjacent to each other within a preselected one of the slots lead to the other end of each of the phase coils, and wherein the phase coils are connected to make a star connection winding.

18. A segment joined armature for a multi-phase *ac* machine as set forth in claim 16, wherein the first and second layer conductors disposed adjacent to each other within a preselected one of the slots lead to an end of each of the phase coils, wherein the fifth and sixth layer conductors disposed adjacent to each other within a preselected one of the slots lead to the other end of each of the phase coils, and wherein the phase coils are connected to make a delta connection winding.

19. A segment joined armature for a multi-phase *ac* machine as set forth in claim 15, wherein each of the phase coils has a bridging conductor segment extending over the anomaly conductor segment

to establish a series connection of the first and second phase windings thereof, the bridging conductor segment including the leg portions one of which is disposed within the slot in which the leg portion of one of the conductor segments leading to one of a pair of terminal leads of the each of the phase coils and forms a leading one of the leg portions of one of the first and second phase windings, and other of which is disposed within the slot in which the leg portion of one of the conductor segments leading to the other of the pair of terminal leads of the each of the phase coils and forms a trailing one of the leg portions of the one of the first and second phase windings, and wherein tip portions of the leg portions of each of the bridging conductor segments are bent in the same circumferential direction of said armature winding.

20. A segment joined armature for a multi-phase *ac* machine as set forth in claim 19, wherein the leg portions of the anomaly conductor segment of the first phase winding are disposed, respectively, within two of the slots in which the leg portions of the anomaly conductor segment of the second phase winding are disposed, and wherein a leg pitch of the leg portions of the anomaly conductor segment of the first phase winding is identical with that of the second phase winding.

21. A segment joined armature for a multi-phase *ac* machine as set forth in claim 15, further comprising a pair of terminal leads defining ends of each of the phase coils which extends from an

outside location in the slot within which the anomaly conductor segment is disposed, and wherein the phase coils are connected in one of a star and a delta form.

22. A segment joined armature for a multi-phase *ac* machine as set forth in claim 15, wherein each of the slots has $6n$ (= integer) of the leg portions of the conductor segments disposed.

23. A segment joined armature for a multi-phase *ac* machine as set forth in claim 17, further comprising a first terminal lead pair and a second terminal lead pair, the first terminal lead pair being made up of terminal leads forming ends of the first and second phase windings of each of the phase coils and leading to the first and second layer conductors disposed within one of the slots, respectively, the second terminal lead pair being made up of terminal leads forming the other ends of the first and second phase windings of each of the phase coils and leading to the fifth and sixth layer conductors disposed within one of the slots, respectively and wherein m is an odd number greater or equal to three, the first terminal lead pairs of the phase coils being located at an interval away from each other which is equivalent to an electrical angle of 2π, wherein the first terminal lead pairs of the phase coils form a first group, the second terminal lead pairs of the phase coils form a second group, and a first angular range occupied by the first group overlap with a second angular range occupied by the second group, wherein each of the first and second angular ranges is an electrical

angle of $2\pi(m-1)/m$, and wherein portions of the first terminal lead pair extending from the conductor segments are shifted from those of the second terminal lead pair by one slot pitch or more.

24. A segment joined armature for a multi-phase *ac* machine as set forth in claim 23, wherein one of the terminal leads of the first terminal lead pair and one of the terminal leads of the second terminal lead pair are connected at a neutral point, the other terminal lead of the first terminal lead pair and the other terminal lead of the second terminal lead pair are connected to phase terminals, respectively, and the phase coils are star-connected to make said armature winding.

25. A segment joined armature for a multi-phase *ac* machine as set forth in claim 24, wherein the neutral point is located at an interval away from a junction of each of the first and second terminal lead pairs to the phase terminal by one slot pitch or more and defined intermediate between the junctions of the first and second terminal lead pairs in the circumferential direction of said armature core.

26. A segment joined armature for a multi-phase *ac* machine as set forth in claim 25, wherein ones of the terminal leads of the first and second terminal lead pairs which extend from the first layer conductors are connected together to define a first neutral point, and ones of the terminal leads of the first and second terminal lead

pairs which extend from the second layer conductors are connected together to define a second neutral point, and wherein the first and second neutral points are separated from each other by given slot pitches in the circumferential direction of said armature core.

27. A segment joined armature for a multi-phase *ac* machine as set forth in claim 23, wherein ones of the terminal leads of the first terminal lead pairs and ones of the terminal leads of the second terminal lead pairs are connected sequentially and lead to phase terminals, wherein the first and second phase windings of each of the phase coils are connected in parallel, and wherein the phase coils are joined together to establish a delta-connection to make said armature winding.

28. A multi-phase *ac* machine comprising:

an armature core having slots, *q* (= integer greater than two or more) for each pole in each phase, the slots being arrayed in a circumferential direction of said armature core; and

an armature winding made up of *m* (= integer greater than three or more) phase coils, each of the phase coils being made up of a first phase winding and a second phase winding which are identical in number of turns and extending in opposite winding directions,

wherein each of the first and second phase windings is made up of at least one wave winding segment and lap winding segments joined alternately, the wave winding segment and the lap winding

segments being formed by sequentially joined-conductor segments, each of the conductor segments including a substantially V-shaped head portion, a pair of leg portions extending from ends of the head portion, disposed in two of the slots of said armature core located at a given interval away from each other, and a pair of joint end portions extending from ends of the leg portions, s (= integer greater than four or more) of the leg portions being arrayed within each of the slots of said armature core in a radius direction of said armature core, each of the joint end portions of each of the conductor segments being joined to one of the joint end portions of another of the conductor segments to make each of the first and second phase windings,

wherein the wave winding segment is made up of the conductor segments having the leg portions located at an interval away from each other which is greater than or equal to one pole pitch, each of the lap winding segments being made up of the conductor segments having the leg portions located at an interval away from each other which is less than one pole pitch, and

wherein an end of the first phase winding and an end of the second phase winding are formed by two of the leg portions of the conductor segments which are disposed adjacent to each other in the radius direction within the same one of the slots of said armature core and which lead to two first terminal leads, and the other end of the first phase winding and the other end of the second phase winding are formed by two of the leg portions of the conductor segments which are disposed adjacent to each other in the radius

direction within the same one of the slots of said armature core and which lead to two second terminal leads.

29. A multi-phase *ac* machine as set forth in claim 28, wherein four of the leg portions of the conductor segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings are broken down into a first and a second group, the first group being made up of the conductor segments having the first and fourth layer conductors separated from each other at a given slot pitch, the second group being made up of the conductor segments having the second and third layer conductors separated from each other at a given slot pitch, wherein tips of the joint end portions leading to the first layer conductors are joined to tips of the joint end portions leading to the second layer conductors, and tips of the joint end portions leading to the third layer conductors are joined to tips of the joint end portions leading to the fourth layer conductors, wherein the wave winding segment is made up of the conductor segments each having the tips of the joint end portions separated from each other at an approximately two pole pitch, and each of the lap winding segments is made up of the conductor segments each having the joint end portions separated from each other at an approximately zero slot pitch, and wherein the first and second layer conductors or the third and fourth layer conductors defining ends of the first and second phase windings of

each of the phase coils disposed within the same one of the slots lead to paired first terminal leads, respectively, and the third and fourth layer conductors or the first and second layer conductors defining other ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired second terminal leads, respectively.

30. A multi-phase *ac* machine as set forth in claim 29, wherein the pairs of the first terminal leads of the phase coils are located at an interval away from each other which is equivalent to an electrical angle of $2\pi / m$ within an electrical angle range of approximately 2π (m-1), and wherein the pairs of the second terminal leads of the phase coils are located at an interval away from each other which is equivalent to an electrical angle of $2\pi / m$ within an electrical angle range of approximately $2\pi(m\text{-}1)$.

31. A multi-phase *ac* machine as set forth in claim 30, wherein the pairs of the second terminal leads form neutral point joint leads which are connected at a neutral point to establish a star-connection of the phase coils.

32. A multi-phase *ac* machine as set forth in claim 29, wherein the first terminal leads of the first and second phase windings of one of the phase coils form input/output lines of a first phase, the first terminal leads of the first and second phase windings of a second one of the phase coils form input/output lines of a second phase,

wherein the second terminal leads of the first and second phase windings of the one of the phase coils are connected to the input/output lines of the second phase, and wherein the first and second phase windings of each of the phase coils are connected in parallel to each other, and the phase coils are connected in a delta form.

33. A multi-phase *ac* machine as set forth in claim 29, wherein each of the first and second phase windings of each of the phase coils includes a first turn coil made up of the wave winding segment and the lap winding segments to form turns around said armature core, a second turn coil made up of the wave winding segment and the lap winding segments to form turns around said armature core, and an anomaly conductor segment connecting the first and second turn coils in series, and wherein the first and second phase windings of each of the phase coils extend in opposite winding directions and are identical electromagnetically with each other.

34. A multi-phase *ac* machine as set forth in claim 33, wherein the anomaly conductor segments of each of the phase coils are disposed adjacent to each other within two of the slots separated from each other at a slot pitch shorter than said slot pitch of the wave winding segment and the lap winding segments by at least one slot pitch.

35. A multi-phase *ac* machine as set forth in claim 29, wherein

locations of interfaces between the first and second terminal leads of each of the phase coils and the conductor segments are defined across the V-shaped head portion of the anomaly conductor segment in a circumferential direction of said armature core.

36. A multi-phase *ac* machine as set forth in claim 28, wherein four of the leg portions of the conductor segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings are broken down into a first and a second group, the first group being made up of the conductor segments having the first and fourth layer conductors separated from each other at a given slot pitch which is shorter than a pole pitch by one slot pitch or more, the second group being made up of the conductor segments having the second and third layer conductors separated from each other at a given slot pitch which is shorter than the pole pitch by one slot pitch or more, wherein tips of the joint end portions leading to the first layer conductors are joined to tips of the joint end portions leading to the second layer conductors, and tips of the joint end portions leading to the third layer conductors are joined to tips of the joint end portions leading to the fourth layer conductors, wherein each of the first and second phase windings includes a first turn coil, a second turn coil, and an anomaly conductor segment, the first turn coil being made up of the wave winding segment formed by the conductor segment having tips

of the joint end portions separated from each other at approximately two pole pitch and the lap winding segment formed by the conductor segments each having tips of the joint end portions separated from each other at approximately one slot pitch, the wave winding segment and the lap winding segments being connected alternately to make turns, the second turn coil made up of the wave winding segment and the lap winding segments connected alternately to make turns extending in the same winding direction as that of the first turn coil, the anomaly conductor segment having legs disposed in two of the slots separated from each other at a pitch different from that of the wave winding segment and the lap winding segments to connect the first turn coil and the second turn coil in series, and wherein the first and second phase windings of each of the phase coils are identical with each other electromagnetically and extend in opposite winding directions.

37. A multi-phase *ac* machine as set forth in claim 36, wherein the anomaly conductor segments of each of the phase coils are disposed adjacent to each other within two of the slots separated from each other at a slot pitch shorter than said slot pitch of the wave winding segment and the lap winding segments by at least one slot pitch.

38. A multi-phase *ac* machine as set forth in claim 36, wherein the first and second layer conductors or the third and fourth layer conductors defining ends of the first and second phase windings of

each of the phase coils disposed within the same one of the slots lead to paired first terminal leads, respectively, and the third and fourth layer conductors or the first and second layer conductors defining other ends of the first and second phase windings of each of the phase coils disposed within the same one of the slots lead to paired second terminal leads, respectively, and wherein the first terminal leads form input/output lines, and the second terminal leads form neutral point joint leads are connected at a neutral point to make a star-connection of the phase coils.

39. A multi-phase *ac* machine as set forth in claim 36, wherein the first terminal leads of the first and second phase windings of one of the phase coils form input/output lines of a first phase, the first terminal leads of the first and second phase windings of a second one of the phase coils form input/output lines of a second phase, wherein the second terminal leads of the first and second phase windings of the one of the phase coils are connected to the input/output lines of the second phase, and wherein the first and second phase windings of each of the phase coils are connected in parallel to each other, and the phase coils are connected in a delta form.

40. A multi-phase *ac* machine as set forth in claim 38, wherein locations of interfaces between the first and second terminal leads of each of the phase coils and the conductor segments are defined across the V-shaped head portion of the anomaly conductor

segment in a circumferential direction of said armature winding.

41. A multi-phase *ac* machine as set forth in claim 36, wherein each of the phase coils has a bridging conductor segment bridging over the anomaly conductor segment to establish a series connection of the first and second phase windings, the bridging conductor segment including leg portions disposed within the slots which are defined by the first and third layer conductors or the second and fourth layer conductors, wherein leg portions of the bridging conductor segment form a trailing one of the leg portions of the conductor segments of the first phase winding and a leading one of the leg portions of the conductor segments of the second phase winding, and wherein the leg portions of each of the bridging conductor segments are disposed within two of the slots which are the same as those within which the leg portions of the first and second phase windings of a corresponding one of the phase coils leading to the first and second terminal leads are disposed.

42. A multi-phase *ac* machine as set forth in claim 28, wherein four of the leg portions of the conductor segments are arrayed within each of the slots of said armature core as a first, a second, a third, and a fourth layer conductors from inside to outside said armature core in the radius direction of said armature core, wherein each of the first and second phase windings includes a first turn coil, a second turn coil, and an anomaly conductor segment, the first turn coil including first lap winding segments, second lap winding

segments, and the wave winding segment which are joined alternately to make turns, the first lap winding segments being made up of ones of the lap winding segments formed by the conductor segments having the joint end portions separated at a joint pitch of approximately 1/2 slot pitch and the second and third layer conductors separated at a first slot pitch shorter than the pole pitch by one slot pitch or more, the second lap winding segments being made up of ones of the lap winding segments formed by the conductor segments having the joint end portions separated at a joint pitch of approximately 1/2 slot pitch and the fourth and fifth layer conductors separated at the first slot pitch, and the wave winding segments having the joint end portions separated at a joint pitch that is identical with two pole pitches minus sum of the joint pitches of the first and second lap winding segments and the first and sixth layer conductors separated at the first slot pitch, the second turn coil being made up of winding segments identical with the first lap winding segments and winding segments identical with the second lap winding segments which are connected alternately to make turns oriented in the same winding direction as that of the first turn coil, the anomaly conductor segment having leg portions disposed within two of the slots separated at a slot pitch different from the first slot pitch to establish a series connection of the first and second turn coils, and wherein the first and second phase windings of each of the phase coils are identical with each other electromagnetically and extend in opposite winding directions.

43. A multi-phase *ac* machine as set forth in claim 42, wherein the first and second layer conductors disposed adjacent to each other within a same one of the slots belong to the first and second phase windings connected in parallel, respectively, and wherein the fifth and sixth layer conductors disposed adjacent to each other within a same one of the slots belong to the first and second phase windings connected in parallel, respectively.

44. A multi-phase *ac* machine as set forth in claim 43, wherein the first and second layer conductors disposed adjacent to each other within a preselected one of the slots lead to an end of each of the phase coils, wherein the fifth and sixth layer conductors disposed adjacent to each other within a preselected one of the slots lead to the other end of each of the phase coils, and wherein the phase coils are connected to make a star connection winding.

45. A multi-phase *ac* machine as set forth in claim 43, wherein the first and second layer conductors disposed adjacent to each other within a preselected one of the slots lead to an end of each of the phase coils, wherein the fifth and sixth layer conductors disposed adjacent to each other within a preselected one of the slots lead to the other end of each of the phase coils, and wherein the phase coils are connected to make a delta connection winding.

46. A multi-phase *ac* machine as set forth in claim 42, wherein each of the phase coils has a bridging conductor segment bridging

over the anomaly conductor segment to establish a series connection of the first and second phase windings thereof, the bridging conductor segment including the leg portions one of which is disposed within the slot in which the leg portion of one of the conductor segments leading to one of a pair of terminal leads of the each of the phase coils and forms a leading one of the leg portions of one of the first and second phase windings, and other of which is disposed within the slot in which the leg portion of one of the conductor segments leading to the other of the pair of terminal leads of the each of the phase coils and forms a trailing one of the leg portions of the one of the first and second phase windings, and wherein tip portions of the leg portions of each of the bridging conductor segments are bent in the same circumferential direction of said armature winding.

47. A multi-phase *ac* machine as set forth in claim 46, wherein the leg portions of the anomaly conductor segment of the first phase winding are disposed, respectively, within two of the slots in which the leg portions of the anomaly conductor segment of the second phase winding are disposed, and wherein a leg pitch of the leg portions of the anomaly conductor segment of the first phase winding is identical with that of the second phase winding.

48. A multi-phase *ac* machine as set forth in claim 42, further comprising a pair of terminal leads defining ends of each of the phase coils which extends from an outside location in the slot within

which the anomaly conductor segment is disposed, and wherein the phase coils are connected in one of a star and a delta form.

49. A multi-phase *ac* machine as set forth in claim 42, wherein each of the slots has $6n$ (= integer) of the leg portions of the conductor segments disposed.

50. A multi-phase *ac* machine as set forth in claim 44, further comprising a first terminal lead pair and a second terminal lead pair, the first terminal lead pair being made up of terminal leads forming ends of the first and second phase windings of each of the phase coils and leading to the first and second layer conductors disposed within one of the slots, respectively, the second terminal lead pair being made up of terminal leads forming the other ends of the first and second phase windings of each of the phase coils and leading to the fifth and sixth layer conductors disposed within one of the slots, respectively and wherein m is an odd number greater or equal to three, the first terminal lead pairs of the phase coils being located at an interval away from each other which is equivalent to an electrical angle of 2π, wherein the first terminal lead pairs of the phase coils form a first group, the second terminal lead pairs of the phase coils form a second group, and a first angular range occupied by the first group overlap with a second angular range occupied by the second group, wherein each of the first and second angular ranges is an electrical angle of $2\pi(m-1)/m$, and wherein portions of the first terminal lead pair extending from the conductor segments are

shifted from those of the second terminal lead pair by one slot pitch or more.

51. A multi-phase *ac* machine as set forth in claim 50, wherein one of the terminal leads of the first terminal lead pair and one of the terminal leads of the second terminal lead pair are connected at a neutral point, the other terminal lead of the first terminal lead pair and the other terminal lead of the second terminal lead pair are connected to phase terminals, respectively, and the phase coils are star-connected to make said armature winding.

52. A multi-phase *ac* machine as set forth in claim 51, wherein the neutral point is located at an interval away from a junction of each of the first and second terminal lead pairs to the phase terminal by one slot pitch or more and defined intermediate between the junctions of the first and second terminal lead pairs in the circumferential direction of said armature core.

53. A multi-phase *ac* machine as set forth in claim 52, wherein ones of the terminal leads of the first and second terminal lead pairs which extend from the first layer conductors are connected together to define a first neutral point, and ones of the terminal leads of the first and second terminal lead pairs which extend from the second layer conductors are connected together to define a second neutral point, and wherein the first and second neutral points are separated from each other by given slot pitches in the circumferential direction

of said armature core.

54. A multi-phase *ac* machine as set forth in claim 50, wherein ones of the terminal leads of the first terminal lead pairs and ones of the terminal leads of the second terminal lead pairs are connected sequentially and lead to phase terminals, wherein the first and second phase windings of each of the phase coils are connected in parallel, and wherein the phase coils are joined together to establish a delta-connection to make said armature winding.